7. REGULATIONS AND ADVISORIES

Zinc (fume and dust) and its compounds are on the list of chemicals appearing in “Toxic Chemicals Subject to Section 313 of the Emergency Planning and Community Right-to-Know Act of 1986” (EPA 1991d).

The national and state regulations and guidelines pertaining to zinc and compounds in air, water, and food are summarized in Table 7-l. No international regulations or guidelines applicable to zinc or its compounds were found.

ATSDR has derived an intermediate oral MRL for zinc based on hematological effects, specifically decreased hematocrit, serum ferritin, and erythrocyte superoxide dismutase activity, in women given supplements containing zinc gluconate for 10 weeks (Yadrick et al. 1989). The intermediate oral MRL has been adopted as the chronic oral MRL.

EPA has derived oral reference doses (RfDs) of 0.3 mg/kg/day for zinc, 0.05 mg/kg/day for zinc cyanide, and 0.0003 mg/kg/day for zinc phosphide (IRIS 1993). EPA has not derived an inhalation reference concentration (RfC) for zinc.

TABLE 7-1. Regulations and Guidelines Applicable to Zinc

Agency	Description	Information	References
NATIONAL			
Regulations:			
a. Air:			
OSHA	PEL		OSHA 1992 (29 CFR 1910.1000)
	Zinc chloride (fume)		
	TWA	1 mg/m^3	
	STEL (15-minute)	2 mg/m^3	
	Zinc chromate (as chromate)		
	Ceiling	0.1 mg/m^3	
	Zinc oxide		
	TWA (fume or respirable fraction)	5 mg/m^3	
	TWA (total dust)	10 mg/m^3	
	STEL (15-minute) (fume)	10 mg/m^3	
b. Water:			
EPA	Designated as a hazardous substance under the Federal Water Pollution Control Act	Yes	EPA 1989a (40 CFR 116.4)
	Designated as a toxic pollutant under the Clean Water Act	Yes	EPA 1981 (40 CFR 401.15)
EPA ODW	Secondary mazimum contaminant level for public water systems		EPA 1991b (40 CFR 143)
	Zinc	5 mg/L	
EPA OWRS	General pretreatment regulations		EPA 1988a
	Listed as a toxic pollutant	Yes	(40 CFR 403, Appendix B)
FDA	Permissible level in bottled water		FDA 1989
	Zinc	5.0 mg/L	(21 CFR 103.35)
c. Food:			
EPA	Tolerance for residues of fungicide basic zinc sulfate, calculated as elemental zinc, in or on raw agricultural commodities		EPA 1973 (40 CFR 180.244)
	Peaches	30 ppm	
d. Other:			
EPA OERR	Reportable quantity		EPA 1989b (40 CFR 302.4)
	Zinc[a]	1,000 pounds	
	Zinc acetate	1,000 pounds	
	Zinc ammonium chloride	1,000 pounds	
	Zinc borate	1,000 pounds	
	Zinc bromide	1,000 pounds	
	Zinc carbonate	1,000 pounds	
	Zinc chloride	1,000 pounds	
	Zinc cyanide	10 pounds	
	Zinc fluoride	1,000 pounds	
	Zinc formate	1,000 pounds	
	Zinc hydrosulfite	1,000 pounds	
	Zinc nitrate	1,000 pounds	
	Zinc phenosulfonate	5,000 pounds	

TABLE 7-1. Regulations and Guidelines Applicable to Zinc *(continued)*

Agency	Description	Information	References
NATIONAL (cont.)			
	Zinc phosphide	100 pounds	
	Zinc silicofluoride	5,000 pounds	
	Zinc sulfate	1,000 pounds	
	zinc, dichloro (4,4-dimethyl-5((((methylamino)carbonyl) oxy)limino)pentanenitrile)-, (T-4) (statutory)	1 pound	EPA 1990b (40 CFR 355, Appendix A)
	Extremely hazardous substances		EPA 1990b (40 CFR 355, Appendix A)
	Threshold planning quantity		
	Zinc, dichloro (4,4-dimethyl-5((((methylamino)carbonyl) oxy)limino)pentanenitrile)-, (T-4) (statutory)	100/10,000 pounds	
	Zinc phosphide	500 pounds	
EPA OSW	Dicarded commercial chemical products, off-specification species, container residues, and spill residues thereof		
	Listing as actue hazardous waste		EPA 1980a (40 CFR 261.33[e])
	Zinc cyanide	Yes	
	Zinc phosphide, when present at concentrations >10%	Yes[b]	
	Listing as toxic waste		EPA 1984a (40 CFR 261.33[f])
	Zinc phosphide, when present at concentrations ≤10%	Yes	
	Listing as a hazardous waste constituent		EPA 1991a (40 CFR 261, Appendix VIII)
	Zinc cyanide	Yes	
	Zinc phosphide	Yes	
EPA OTS	Toxic chemical release reporting		EPA 1991d (40 CFR 372)
	Zinc (fume or dust)	Yes	
Guidelines:			
a. Air:			
ACGIH	TLV		ACGIH 1991
	Zinc chloride (fume)		
	TWA	1 mg/m^3	
	STEL	2 mg/m^3	
	Zinc oxide		
	TWA (fume)	5 mg/m^3	
	TWA (total dust)	10 mg/m^3	
	STEL (fume)	10 mg/m^3	

TABLE 7-1. Regulations and Guidelines Applicable to Zinc *(continued)*

Agency	Description	Information	References
NATIONAL (cont.)			
NIOSH	REL		NIOSH 1992
	Zinc oxide (fume)		
	TWA	5 mg/m^3	
	STEL	10 mg/m^3	
	Zinc oxide (dust)		
	TWA	5 mg/m^3	
	TWA ceiling (15-minute)	15 mg/m^3	
	Zinc chloride (fume)		
	TWA	1 mg/m^3	
	STEL	2 mg/m^3	
b. Water:			
EPA OWRS	Ambient water quality criterion	5 mg Zn/L	EPA 1980c
NAS	Drinking water standard	5 mg Zn/L	NAS 1977
c. Food:			
NAS	RDA	15 mg/day (men) 12 mg/day (women)	NAS/NRC 1989b
d. Other:			
EPA	Oral RfD		
	Zinc	0.3 mg/kg/day	IRIS 1993
	Zinc cyanide	0.05 mg/kg/day	
	Zinc phosphide	0.0003 mg/kg/day	
STATE			
Regulations and Guidelines:			
a. Air:	Average acceptable ambient air concentrations		NATICH 1993
	Zinc		
Maryland		0.00	
Maine		0.00	
Montana	(24 hour)	39.3 µg/m^3	
Montana	(1 year)	6.55 µg/m^3	
New York	(1 year)	0.03 µg/m^3	
Vermont	(24 hour)	12.0 µg/m^3	
	Zinc chloride (fume)		
Arizona	(1 hour)	17.0 µg/m^3	
Arizona	(24 hour)	8.0 µg/m^3	
California (Mont.)		0.00	
Connecticut	(8 hour)	20.0 µg/m^3	
Florida (Tampa)	(8 hour)	0.01 µg/m^3	

TABLE 7-1. Regulations and Guidelines Applicable to Zinc *(continued)*

Agency	Description	Information	References
STATE (cont.)			
Florida (Fort Lauderdale)	(8 hour)	0.01 $\mu g/m^3$	
Florida (Pinella)	(8 hour)	10.0 $\mu g/m^3$	
Florida (Pinella)	(24 hour)	2.4 $\mu g/m^3$	
Maryland		0.00	
North Dakota	(8 hour)	0.01 $\mu g/m^3$	
North Dakota	(1 hour)	0.02 $\mu g/m^3$	
Nevada	(8 hour)	0.024 $\mu g/m^3$	
New York	(1 year)	3.3 $\mu g/m^3$	
Oklahoma	(24 hour)	20.0 $\mu g/m^3$	
South Dakota	(8 hour)	10.0 $\mu g/m^3$	
Texas	(30 min)	10.0 $\mu g/m^3$	
Texas	(1 year)	1.0 $\mu g/m^3$	
Virginia	(24 hour)	17.0 $\mu g/m^3$	
Vermont	(24 hour)	2.4 $\mu g/m^3$	
Washington (Southwest)	(24 hour)	3.3 $\mu g/m^3$	
	Zinc oxide (fume)		
Arizona	(1 hour)	83.0 $\mu g/m^3$	
Arizona	(24 hour)	40.0 $\mu g/m^3$	
Connecticut	(8 hour)	100.0 $\mu g/m^3$	
Florida (Tampa)	(8 hour)	0.05 $\mu g/m^3$	
Florida (Fort Lauderdale)	(8 hour)	0.05 $\mu g/m^3$	
Florida (Pinella)	(8 hour)	50.0 $\mu g/m^3$	
Florida (Pinella)	(24 hour)	12.0 $\mu g/m^3$	
Louisiana	(8 hour)	119.0 $\mu g/m^3$	
North Dakota	(8 hour)	0.05 $\mu g/m^3$	
North Dakota	(1 hour)	0.1 $\mu g/m^3$	
Nevada	(8 hour)	0.119 $\mu g/m^3$	
New York	(1 year)	16.7 $\mu g/m^3$	
Oklahoma	(24 hour)	500.0 $\mu g/m^3$	
Texas	(30 min)	50.0 $\mu g/m^3$	
Texas	(1 year)	5.0 $\mu g/m^3$	
Virginia	(24 hour)	83.0 $\mu g/m^3$	
Virginia	(24 hour)	170.0 $\mu g/m^3$	
Washington (Southwest)	(24 hour)	16.7 $\mu g/m^3$	

TABLE 7-1. Regulations and Guidelines Applicable to Zinc *(continued)*

Agency	Description	Information	References
STATE (cont.)			
	Drinking water quality		
Alabama		5 mg/L	CELDS 1993
Arizona		5 mg/L	FSTRAC 1990
California		5 mg/L	CELDS 1993
Colorado		5 mg/L	CELDS 1993
Delaware		5 mg/L	CELDS 1993
Florida		5 mg/L	CELDS 1993
Georgia		5 mg/L	CELDS 1993
Idaho		5 mg/L	CELDS 1993
Illinois		5 mg/L	CELDS 1993
Kansas		5 mg/L	FSTRAC 1990
Kentucky		5 mg/L	CELDS 1993
Louisiana		5 mg/L	CELDS 1993
Maine		5 mg/L	CELDS 1993
Minnesota	Classes A and B	5 mg/L	CELDS 1993
Missouri		5 mg/L	CELDS 1993
Nevada		5 mg/L	CELDS 1993
New Hampshire		5 mg/L	CELDS 1993
New Jersey		5 mg/L	CELDS 1993
New York		5 mg/L	CELDS 1993
Oregon		5 mg/L	CELDS 1993
Rhode Island		5 mg/L	FSTRAC 1990
Tennessee		5 mg/L	CELDS 1993
Texas		5 mg/L	CELDS 1993
Utah		5 mg/L	CELDS 1993
Vermont		5 mg/L	FSTRAC 1990
Virginia		5 mg/L	CELDS 1993
Washington		5 mg/L	CELDS 1993
Wisconsin		5 mg/L	CELDS 1993
	Groundwater		CELDS 1993
Colorado	Agricultural standards	2 mg/L	
Massachusetts	MAL for Classes I and II	5 mg/L	
Missouri	Criteria	5 mg/L	
Nebraska	MCL	5 mg/L	
New Jersey	Criteria for Classes GW1, GW2, GW3	5 mg/L	
New Mexico	Domestic water supply	10 mg/L	
New York	MAC	5 mg/L	
North Carolina		5 mg/L	

TABLE 7-1. Regulations and Guidelines Applicable to Zinc *(continued)*

Agency	Description	Information	References
STATE (cont.)			
Oregon	Quality guidance levels	5 mg/L	
Virginia	Statewide standards	0.05 mg/L	
Wisconsin	Public welfare standards		
	Enforcement standard	5 mg/L	
	Preventive action limit	2.5 mg/L	
Wyoming	MCL		
	Class I (Domestic)	5 mg/L	
	Class II (Agriculture)	2 mg/L	
	Class II (Livestock)	25 mg/L	
	Surface water		CELDS 1993
California	Background seawater concentrations	8 µg/L	
	Estimate of chronic toxicity	51 µg/L	
District of Columbia	Total recoverable		
	Class C	0.05 mg/L	
	Class E	5 mg/L	
Florida	Quality standard	1 mg/L	
	Class III waters	0.03 mg/L	
Iowa	Maximum chemical level		
	Class B	1 mg/L	
	Class C	1 mg/L	
Maryland	Criteria for aquatic life protection		
	Freshwater acute	120 µg/L	
	Freshwater chronic	110 µg/L	
	Salt water acute	95 µg/L	
	Salt water chronic	86 µg/L	
Mississippi	Freshwater acute criteria	65 µg/L[c]	
	Freshwater chronic criteria	59 µg/L[c]	
	Salt water acute criteria	95 µg/L	
	Salt water chronic criteria	86 µg/L	
North Carolina	Action level	50 µg/L	
Oklahoma	Acute criteria	Must be calculated[d]	
	Chronic criteria	Must be calculated[e]	
Puerto Rico	Standards for toxic substances	50 µg/L	
Texas	Fresh acute and chronic	Must be calculated[d]	
	Marine acute	98 µg/L	
	Marine chronic	89 µg/L	
Virginia	Criteria for protection of aquatic life		
	Freshwater chronic	47 µg/L	
	Salt water chronic	58 µg/L	
Wyoming	Water quality standard		
	Special Class A	0.05-0.6mg/L	

TABLE 7-1. Regulations and Guidelines Applicable to Zinc *(continued)*

Agency	Description	Information	References
STATE (cont.)			
	Public water		CELDS 1993
Arkansas	MCC	5 mg/L	
Florida	Class I waters	0.03 mg/L	
Ohio	Secondary MCL	5 mg/L	
Oklahoma	Raw water numerical limits	5 mg/L	
Virginia	Surface water for human consumption	5 mg/L	
West Virginia	Secondary MCL	5 mg/L	
	General water quality standards		CELDS 1993
Alabama	Freshwater acute criteria	Must be calculated[d]	
	Freshwater chronic criteria	Must be calculated[e]	
	Marine acute criteria	96 µg/L	
	Marine chronic criteria	86 µg/L	
	Consumption of fish and water	5 mg/L	
	Consumption of fish only	5 mg/L	
Arizona	Water quality criteria		
	Domestic water source	5000 µg/L[f]	
	Full body contact	28000 µg/L	
	Partial body contact	28000 µg/L	
	Acute and chronic criteria for aquatic and wildlife uses		
	Cold water fishery, warm water fishery, effluent dominated water, and ephemerol	Dependent upon dissolved	
California	Limitations for protection of marine aquatic life		
	6-Month median	20 µg/L	
	Daily maximum	80 µg/L	
	Instantaneous maximum	200 µg/L	
Connecticut	Aquatic life criteria		
	Freshwater acute	35.3 µg/L	
	Freshwater chronic	12.3 µg/L	
	Salt water acute	95 µg/L	
	Salt water chronic	86 µg/L	
Delaware	Criteria for protection of aquatic life		
	Fresh acute	Must be calculated[d]	
	Fresh chronic	Must be calculated[e]	
	Marine acute	95 µg/L	
	Marine aquatic	86 µg/L	
Hawaii	Standards for all waters		
	Freshwater acute	22 µg/L[g]	
	Freshwater chronic	22 µg/L[g]	
	Salt water acute	95 µg/L	
	Salt water chronic	86 µg/L	

TABLE 7-1. Regulations and Guidelines Applicable to Zinc *(continued)*

Agency	Description	Information	References
STATE (cont.)			
Illinois	Chemical constituent level	1 mg/L	
	Secondary contact and indigenous aquatic life		
	Chemical constituent levels	1 mg/L	
Indiana	Acute aquatic criteria	Must be calculated[d]	
	Chronic aquatic criteria	Must be calculated[e]	
Louisiana	Criteria for aquatic life protection		
	Acute		
	Freshwater	65, 120, 210 µg/L[h]	
	Marine water	95.00 µg/L	
	Chronic		
	Freshwater	59, 110, 190 µg/L[h]	
	Marine water	86.00 µg/L	
Mississippi	Criteria for all waters		
	Organisms only	5 mg/L	
	Water and organisms	5 mg/L	
Missouri	Protection of aquatic life		
	CWF chronic	175 µg/L	
	Lakes chronic	105 µg/L	
	GWWF chronic	245 µg/L	
	LWWF chronic	1065 µg/L	
	CWF acute	190 µg/L	
	Lakes acute	115 µg/L	
	GWWF acute	270 µg/L	
	LWWF acute	1180 µg/L	
	Human health protection		
	CWF chronic	240 µg/L	
	Lakes chronic	150 µg/L	
	GWWF chronic	345 µg/L	
	LWWF chronic	1505 µg/L	
	CWF acute	270 µg/L	
	Lakes acute	165 µg/L	
	GWWF acute	380 µg/L	
	LWWF acute	1660 µg/L	
	Drinking water supply		
	CWF chronic	310 µg/L	
	Lakes chronic	190 µg/L	
	GWWF chronic	440 µg/L	
	LWWF chronic	1920 µg/L	
	CWF acute	345 µg/L	
	Lakes acute	210 µg/L	
	GWWF acute	490 µg/L	
	LWWF acute	2120 µg/L	

TABLE 7-1. Regulations and Guidelines Applicable to Zinc *(continued)*

Agency	Description	Information	References
STATE (cont.)			
Nevada	Irrigation	<2 mg/L	
	Watering of livestock	<25 mg/L	
	Propagation of wildlife only	<25 mg/L	
New York	MAC		
	Classes A, A-S, AA, AA-S, GA	300 µg/L[i]	
	Classes A, A-S, AA, AA-S, B, C	30 µg/L[j]	
	Class D	Must be calculated[k,l]	
	Classes SA, SB, SC	58 µg/L[j]	
	Class SD	170 µg/L[k]	
North Dakota	Class I streams	Must be calculated[d]	
Oklahoma	Maximum effluent concentration	1 mg/L	
South Dakota	Aquatic life value concentrations		
	Acute (CMC)	120.0 µg/L[h]	
	Chronic (CCC)	110.0 µg/L[h]	
Utah	Criteria for aquatic wildlife		
	3A, 3B, 3C, and 3D		
	1-hour average	120 µg/L	
	4-day average	110 µg/L	
	Protection of human health		
	Class 3 MCL	5000 µg/L	
Vermont	Criteria for protection of aquatic biota for all classes		
	Acute	Must be calculated[l]	
	Chronic	Must be calculated[d]	
West Virginia	Water quality criterion		
	B2	47 µg/L	
	B1, B3	Dependent on hardness	
	A	Dependent on hardness	

[a]No reporting of releases of this hazardous substance is required if the diameter of the pieces of the solid metal released is equal to or exceeds 100 micrometers (0.004 inches).
[b]The primary hazardous properties of this material are toxicity and reactivity.
[c]Hardness-dependent parameter. All criteria are as indicated at hardness less than or equal to 50 mg/L, as calcium carbonate. If hardness exceeds 50 mg/L, as calcium carbonate, then criteria is equal to result of hardness based equations as found in quality criteria for water.
[d]exp(0.8473[ln(hardness as mg/L)] + 0.8604) µg/L
[e]exp(0.8473[ln(hardness as mg/L)] + 0.7614) µg/L
[f]Total recoverable
[g]The value listed is the minimum standard. Depending upon the receiving water calcium carbonate hardness, higher standards may be calculated using the respective formula in the EPA publication "Quality Criteria for Water" (EPA 440/5-86-001, revised May 1, 1987).
[h]Hardness-dependent criteria for this chemical
[i]This standard is health based.
[j]This standard is aquatic based, and the procedure used as a basis for the standard is propagation.

(Footnotes continued on next page)

TABLE 7-1. Regulations and Guidelines Applicable to Zinc *(continued)*

Agency	Description	Information	References

FOOTNOTES (cont.)

[k]This standard is aquatic based, and the procedure used as a basis for the standard is survival.
[l]Calculated as exp(0.83[ln(hardness as mg/L)] + 1.95) µg/L

ACGIH = American Conference of Governmental Industrial Hygienists; Class I (Florida) = Surface waters (except mixing zones) designated as Class I for use as a potable supply; Class I (Massachusetts) = Fresh ground waters found in the saturated zone of unconsolidated deposits or consolidated rock and bed rock - a source of potable water supply; Class I (Wyoming) = Suitable for domestic use; Class I streams (North Dakota) = The quality of waters in this class shall be such as to permit the propagation or life, or both, of resident fish species and other aquatic biota and shall be suitable for boating, swimming, and other water recreation; Class II (Massachusetts) = Saline waters found in the saturated zone of the unconsolidated deposits or consolidated rock and bed rock as a source of potable mineral waters, for conversion to fresh potable waters, or as raw material for the manufacture of sodium chloride or its derivatives or similar products; Class II (Wyoming) = Suitable for agriculture where soil conditions and other factors are adequate; Class III (Florida) = Designated for recreation and propagation and maintenance of a healthy population of fish and wildlife; Class III (Wyoming) = Suitable for livestock; Class 3 (Utah) = Protected for in-stream use by aquatic wildlife; Class 3A (Utah) = Protected for cold water species of game fish and other cold water aquatic life, including the necessary aquatic organisms in their food chain; Class 3B (Utah) = Protected for warm water species of game fish and other warm water aquatic life, including the necessary aquatic organisms in their food chain; Class 3C (Utah) = Protected for nongame fish and other aquatic life, including the necessary aquatic ortanisms in their food chain; Class 3D (Utah) = Proteced for waterfowl, shore birds and other water-oriented wildlife not included in Classes 3A, 3B, or 3C, including the necessary aquatic organisms in their food chain; Class A (West Virginia) = water supply, public; Classes A, A-S, AA, AA-S, B, C, and D (New York) = Classified as fresh surface waters; Class B1 (West Virginia) = warm water fishery streams; Class B3 (West Virginia) = small non-fishable streams; Class B2 (West Virginia) = trout waters; Class C (DC) = Protected for aquatic life, waterfowl, shore birds and water-oriented wildlife; Class E (DC) = Protected for use as a raw water source for industrial water supply; Class GA (New York) = Classified as fresh groundwater; Class GW1 (New Jersey) = Groundwater in the Central Pine Barrens suitable for potable water supply, agricultural water supply, and continual replenishment of surface waters to maintain existing quantity and quality of the surface waters in Central Pine Barrens and other reasonable uses; Class GW2 (New Jersey) = Groundwater, having a natural total dissolved solids (TDS) concentration of 500 mg/L or less, suitable for potable, industrial, or agricultural water supply, after having conventional water treatment where indicated; Class GW3 (New Jersey) = Groundwater, having a natural TDS concentration between 500 mg/L and 10,000 mg/L, suitable for conversion to fresh potable waters, or other beneficial uses; Classes SA, SB, SC, and SD (New York) = Classified as saline surface waters; CWF = cold-water fishery; EPA = Environmental Protection Agency; FDA = Food and Drug Administration; GWWF = general warm-water fishery; LWWF = limited warm-water fishery; MAC = maximum allowable concentration; MAL = maximum allowable level; MCC = maximum contaminant concentration; MCL = maximum contaminant level; NAS = National Academy of Sciences; NIOSH = National Institute for Occupational Safety and Health; ODW = Office of Drinking Water; OERR = Office of Emergency and Remedial Response; OSHA = Occupational Safety and Health Administration; OSW = Office of Solid Waste; OTS = Office of Toxic Substances; OWRS = Office of Water Regulations and Standards; PEL = Permissible Exposure Level; RDA = Recommended Daily Allowance; REL = Recommended Exposure Limit; RfD = reference dose; Special Class A (Wyoming) = Suitable for fish and aquatic life; STEL = Short-term Exposure Limit; TLV = Threshold Limit Value; TSCA = Toxic Substances Control Act; TWA = Time-Weighted Average; Water Class A (Minnesota) = Without treatment the raw waters will meet the state's drinking water standards (This standard will ordinarily be restricted to underground waters with a high degree of natural protection); Water Class B (Iowa) = Class B waters are designated for wildlife, fish, aquatic and semi-aquatic life, and secondary contact water uses; Water Class B (Minnesota) = With minimum disinfection the treated water will meet requirements for drinking water (This standard will ordinarily be restricted to surface and underground waters with a moderately high degree of natural protection); Water Class C (Iowa) = Class C waters are designated for raw water sources for potable water supply; Zn = zinc